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ABSTRACT

This is a curriculum guide in marine education for grades two and three. It gives information for the setup and maintenance of marine aquariums, as well as information on the care and feeding of marine animals. The unit should take about three or four weeks. A calendar is given showing the amount of time needed for each part. The guide is divided into seven parts entitled: (1) Setting Up; (2) Observing Marine Animals; (3) Inferring About Marine Animals; (4) Classifying Beings 'n Things; (5) Inferring About Parts of Living Things; (6) Problem Solving; and (7) Evaluation. Each section contains two to four student activities. A list of related books and films are also given for each section. (RE)

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SENSING THE SEA

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grades two-three

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SENSING THE SEA

A Curriculum Guide in Marine Education

for

grades two and three

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of

The College of William and Mary

and
contributing editor to the
introduction

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and
School of Education
of the
College of William and Mary in Virginia
1978

PREFACE

Most education is very land-oriented. Children learn shapes, colors, sizes, and textures from materials, plants, and animals found on land. There is another 70 percent of the earth that many people ignore, the sea. If young children are to develop responsible attitudes through total understanding of the earth, they must be exposed to all of its environments.

The overall purpose of this unit is to arouse curiosity and interest in the aquatic environment through involvement. The teacher's role is one of asking divergent questions for which the student proposes possible solutions rather than deciding specific "correct" answers. Throughout these lessons, the process of investigation is most important. Facts about specific content are vehicles for developing interest in the marine environment and for teaching inquiry skills. As was most appropriately expressed by Will Hon of the Skidaway Island Marine Extension Center:

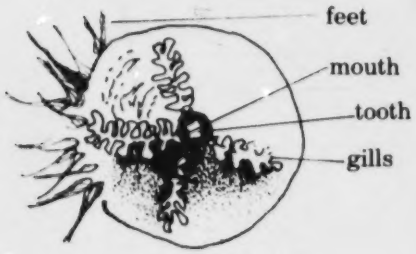
> **"The unique quality of environmental studies is that there are no finite answers. Asking questions, which has always been the teachers' prerogative, turns out to be the skill that we should have been teaching[students] all along."**

Since science is both a body of knowledge and a process of inquiry, this unit attempts to develop both the spirit as well as the substance of science.

MARINE ANIMAL WORKSHEET

You may wish to reproduce copies of this sheet for your class, and use it for adding lines to the drawings on pages 5, 6, and 7 of *Sensing the Sea*.

SEA URCHIN



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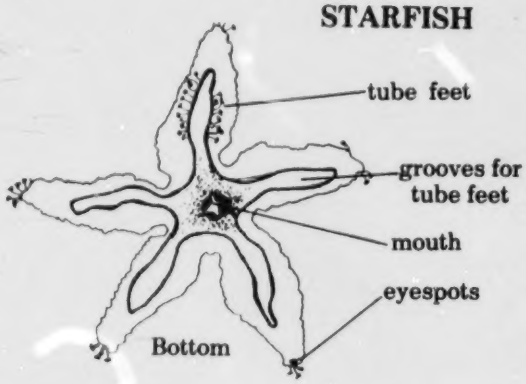
STARFISH



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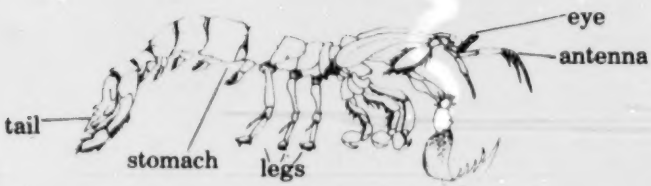
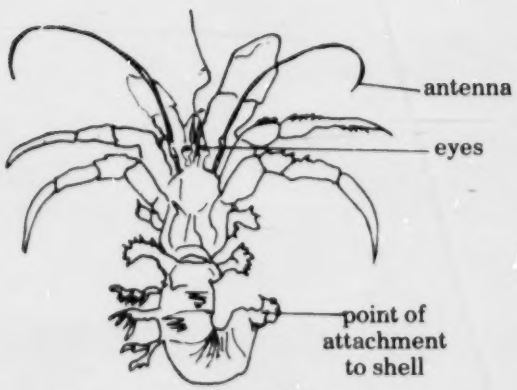
MANTIS SHRIMP

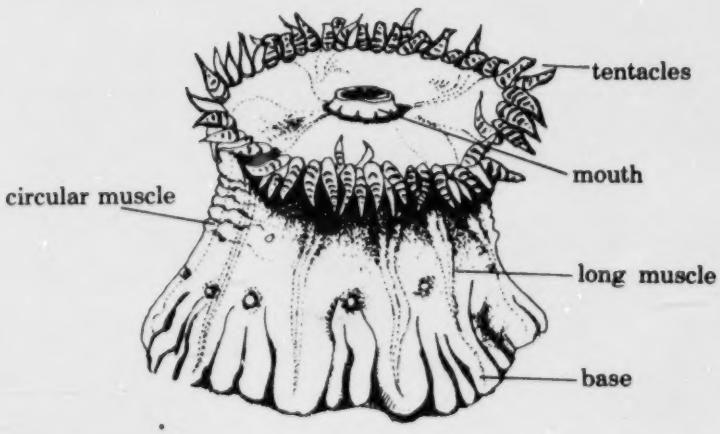


HERMIT CRAB



Hermit Crab out of Shell

SEA ANEMONE



FISH

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INTRODUCTION

Before starting the unit read the entire set of "Helpful Hints" included in this section to become familiar with equipment and procedures necessary for maintaining a marine aquarium. **All of these procedures will be carried out with and by your students.** The function of this introductory material is to provide background information for you. It should not be presented to your class; it should be used by you to focus your students' questioning. Student discovery through personal involvement is vital for developing an awareness of and sensitivity to the marine environment.

HELPFUL HINTS FOR SETTING UP AND MAINTAINING A SALT WATER AQUARIUM IN YOUR CLASSROOM

Setting up and maintaining a marine aquarium can be fun and exciting. Contrary to popular belief, the care of the marine aquarium does not require sophisticated equipment or experience.

SELECTING THE TANK

Check your local pet store and explore its tanks and supplies. Tanks come in a variety of shapes and sizes. In selecting a tank, keep in mind that although larger tanks are easier to maintain, they are more expensive. A ten gallon tank is certainly a good size for the classroom, although, if you can afford it, a twenty gallon tank is better. Larger rectangular tanks come in two styles, one greater in depth, and one with greater length. The lower, longer tanks are preferred because they provide more water surface area exposed to air and more bottom area important to the growth of beneficial bacteria.

Select an all-glass tank sealed with clear silicon sealant. One-piece plastic frames provide adequate support and do not rust. Check for a recessed ridge around the top of the aquarium. This feature will hold a plastic or plexiglass cover, handy for cutting down on splashing, evaporation, and the possible mischievous introduction of foreign materials.

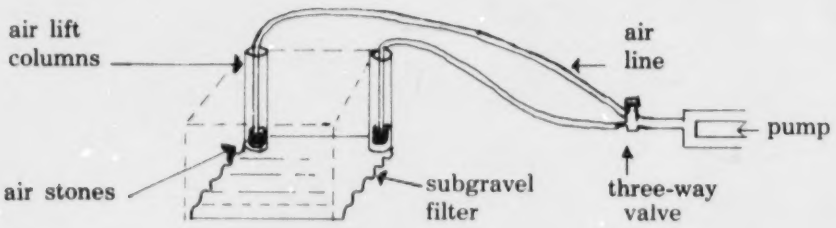
Fill the tank with water. If it leaks, return it. Do not try to fix it. If it seems to be leakproof, add a handful of non-iodized salt (available in most supermarkets) and allow it to soak overnight. Salt water tends to loosen seals if they are not glued properly. If drops of liquid or salt crystals form along the edges of the tank, return it.

Dip out as much water as possible with a cup or a siphon and then carefully tip the tank to empty the remainder. Remember never move a filled or partially filled tank. The seals and glass are not strong enough to support any shifting weight and can break as you are carrying it.

EQUIPMENT*

- 10 gallon tank
- subgravel filter, with air lift columns
- gravel (approx. 2 lb/gal. water)
- lights and lid (can be added later or hand-made)
- small net
- large plastic tube to be used as a siphon
- teflon sponge
- pump
- 2 air stones
- air line (3 ft.)
- three-way valve
- thermometer
- hydrometer
- 1 pkg. artificial sea water slats for 10 gal. tank

Note: If artificial plants are used, they must be made for salt water aquarium use. Artificial plants for home use are not suitable because they may rust and leach harmful chemicals into the water.



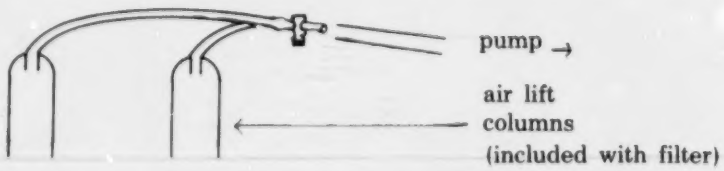
The perforated plastic plate that rests on the bottom of the tank is the **subgravel filter.** While supporting the gravel, the filter allows for circulation. It helps prevent stagnant areas where toxic substances may develop. An airlift tube pulls water from the tank through the gravel where wastes are filtered out. Bacteria living in the gravel break down any organic material and prevent it from polluting the aquarium. A chemical balance will establish itself in a saltwater aquarium set-up as described.

Gravel sold for use in a salt water aquarium contains calcium. Limestone, crushed oyster shell, coral rock, or dolomite are some acceptable examples. The gravel will be somewhat uniform in size. Obtain enough gravel for a three inch layer on the bottom of the tank as well as a replacement supply (approx. two pounds for each gallon of water). Students should rinse the gravel several times with tapwater until the wash water is no longer cloudy.

The air-flow system consists of an **air pump, two air-lift columns, air line** of appropriate diameter, and **air stones.**

The three-way valve controls the amount and pathways of air going into the tank from the pump. It is attached as shown:

Spaces are provided on the filter for attaching air-lift columns. Attach air stones to the stems on the bottom of the columns. The columns are attached to the pump by connecting air tubing to the top as shown:

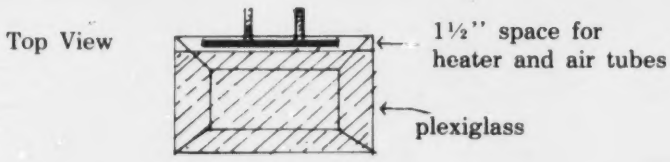


*Local pet stores as well as pet departments of department stores carry this equipment. See Appendix A for a list of specialty order houses.

Note: The function of the pump and the airstone is to create bubbles which will cause the water to circulate to the surface. Air moves into the water at the surface; it is not forced into the water through the airstone.

Heaters are selected according to the size of the tank. One is necessary if the water temperature will drop below 15°C (60°F) even for a short period of time. Gradual slight temperature changes of 5° to 10° over a long period of time such as during winter school break usually do not cause problems. Sudden temperature fluctuations, however, are not easily adapted to by most organisms.

Covers are usually attached to the lights; such covers are expensive and not necessary for your classroom aquarium. A home-made plastic or plexiglass top that rests over the top of the tank is certainly adequate. This serves to reduce evaporation as well as to prevent the mischievous appearance of erasers and pencils in the aquarium.



Artificial sea water salts can be purchased at any aquarium supply store. Follow the directions on the package closely. **Natural sea water** is not recommended because it often contains microscopic organisms or pollutants which can contaminate the water.

Since your students will be handling a **hydrometer** frequently in order to measure the amount of salt dissolved in their aquarium water, purchase one that is plastic rather than glass.

DECIDING WHERE TO PLACE YOUR AQUARIUM

Where you place your aquarium is important to the health of your animals as well as to its effectiveness as a teaching device. A sturdy support system is necessary since sea water is quite heavy (a table, desk, or cinder blocks are fine). Once your aquarium contains water, even a small amount, do not attempt to move it. You may break the seals or the glass. Avoid direct sunlight; it will cause the temperature to fluctuate too much, as well as promoting excessive algae growth on the sides of the aquarium. The aquarium should be placed in an area of fairly constant temperature, away from exits to the out of doors or open windows. Fish are cold-blooded, which means that their body temperature fluctuates with that of the water they are in. Sudden changes lead to stress, disease, and death. If possible the aquarium should be placed in a well-traveled area; this permits the fish to become familiar with external movement and makes them easier to observe and handle when necessary.

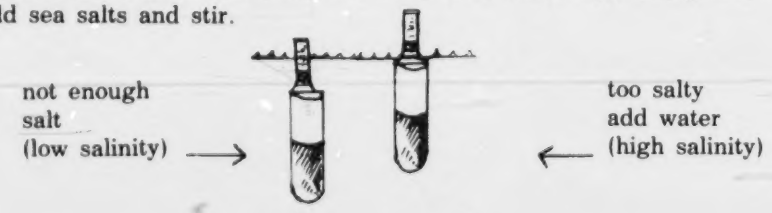
MAINTENANCE SCHEDULE

Daily observations:

Check to see that:
--pump runs smoothly--even-sized bubbles adjusted by the gang valve
--remove dead animals
--check water temperature with thermometer. It should be between 20°-25°C (68°-77°F)
--wipe salt from outside edges of the aquarium

Weekly:

Check salinity by reading the numbers on the hydrometer where the water level crosses the scale (1.020-1.025). If this area of the scale is above the water level (too salty), slowly add fresh water. If it is below, slowly add sea salts and stir.



Clean inside front of the glass by taking a clean (dry) sponge and wiping the glass gently. Never use soap or window cleaners. They will kill the fish.

Check and maintain the water level--5 cm (2 in.) from top of aquarium.

Monthly:

Remove one fourth of aquarium water with a plastic cup or bowl. The replacement sea water must be the same temerature and salinity as the water in the aquarium, so be sure to prepare it several days before changing the old water.

After a period of time (perhaps a month) algae will begin to grow on the bottom and sides of the aquarium. It tints the glass green or brown. This is not harmful. In fact it is a food source for some of your animals. It also helps maintain the chemical balance within the aquarium. Remove it from just the viewing side of the aquarium by gently wiping a sponge or paper towel along the inside of the glass. Algae scrapers are also available at pet stores.

Keep a supply of sea water on hand to use with student activities as well as for monthly maintenance. A well-rinsed milk jug with a plastic cap works well. Do not use a metal can or lid; it will rust and alter both the salt and metal content of the water. Follow the directions carefully on the artificial sea salt package.

ANIMAL CARE

Be sure that your aquarium is ready, allowing at least 48 hours (a weekend) for the temperature and salinity to stabilize, before buying or collecting animals.

If you are buying them from a store, here are some things to observe before purchasing them:

1. The colors of a healthy fish should be bright and clear.
2. Avoid fish with poor skin conditions, such as blemishes or white patches. This may indicate disease.
3. Rapid breathing or erratic swimming may also be a sign of disease.
4. Starving fish have a pinched belly behind the side fin as shown here .

5. Begin your aquarium with the least expensive animals that you can buy. Make sure that they survive before adding more exotic species.

FEEDING

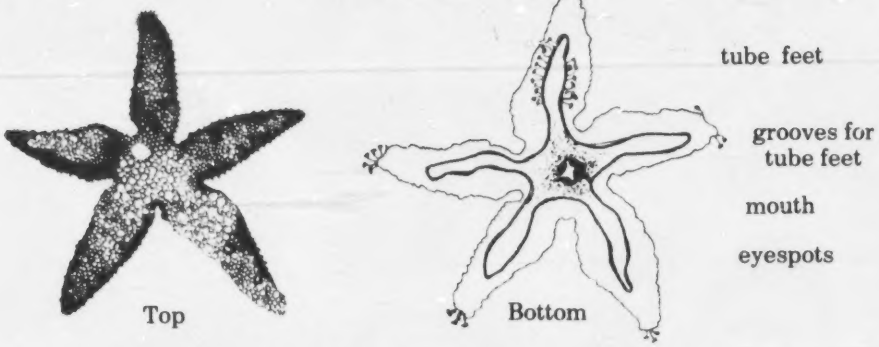
Do not feed right away. Wait 24 hours. It is normal for animals to "fast" for a day or two. Consult your local pet store for suggested favorite foods of your animals. If they don't eat the food within 15 minutes, remove it. Decaying food can contaminate the water.

Fish like variety in their diets. In addition to dry flake food available from pet stores, you can feed your fish frozen shrimp, clams, squid, or mussels twice a week (these may be available as scraps from a local fish store). Place this food in direct contact with sea anemones, sea urchins, starfish, and sand dollars. Frozen and live brine shrimp are excellent for feeding most of your animals. Some animals need to be fed twice daily, others need to be fed only every second or third day. Drop very small amounts of food in the aquarium. Wait until it is consumed before adding more. Watching an animal's eating behavior will quickly show you its requirements. Overfeeding is a greater problem than underfeeding. Fish can go days or even a week without food (although this practice is not encouraged!).

ABOUT THE ANIMALS

Since you and your students are setting up an aquarium in which some of the animals will be handled and removed from the water for brief periods of time, hardy animals such as starfish, crabs, shrimp, sea anemones, and sea urchins are recommended. They are very hardy. Some fishes such as blennies, toadfish, and mummichogs are more durable than others and can also be used. Delicate tropical fishes require more care. Peculiarities of some popular marine critters are discussed below.

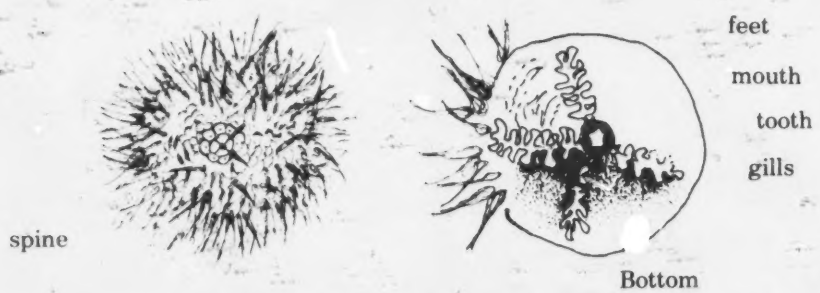
STARFISH



Starfish are popular spiny-skinned marine animals often found along the jetties and piers. Upon careful examination, you will find tiny pin-points of red or purple at the tip of each arm; these are "eyes". The "eyes" can only sense light and darkness. At the top of the animal is an orange spot which is filled with holes like a sieve plate. When magnified by a hand lens, it looks like a tea strainer. Water goes through this (straining out dirt and one-celled animals and plants) and into the starfish's "water system." The water enters the tube feet, makes them swell, and helps the animal move slowly over rocks and other hard surfaces. If you turn a starfish on its back, it will right itself by using its tube feet.

The mouth is on the bottom in the center of the "star". It feeds on large pieces of food by extending the lower part of its stomach through the mouth and enveloping the prey externally, much to the delight of students. The starfish eats shellfish such as oysters and clams by mounting the shell and clamping its arms around it. The "suckers" on the bottom of the tube feet attach themselves to the shells and rapidly pull them apart. The starfish then inserts its own stomach between the shells and digest its prey. In order to view the feeding process, place food such as mussels, clams, scallops, or oysters under the starfish.

SEA URCHIN



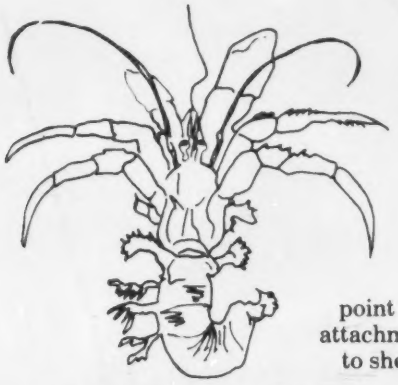
The sea urchin is another of the spiny-skinned marine animals that inhabits rock pilings and piers. Many of these creatures creep over the bottom, gorging themselves on bits of plant and animal material. In your aquarium they will often creep along the walls of the glass, scraping bacteria and algae as they go. Like the starfish they also move by throwing out tube feet and re-orienting their hard spines, although the spines are used primarily for defense. The mouth is on the bottom and is surrounded by five pairs of teeth for scraping algae off rocks. They also have the power of regenerating spines when they are broken off.

MANTIS SHRIMP

The mantis shrimp is an aggressive animal in an aquarium, burying itself under rocks and occasionally making shallow burrows in the mud. It can maneuver itself forward and backward and is quite adept at catching it prey. The mantis shrimp is a carnivore and may view a bit of your finger as a delicacy. Be careful!

It has a grey-green plastic-like outer skeleton with deep grooves separating different regions of the body. Green eyes mounted on narrow stalks are quite pronounced in the head region.

HERMIT CRAB

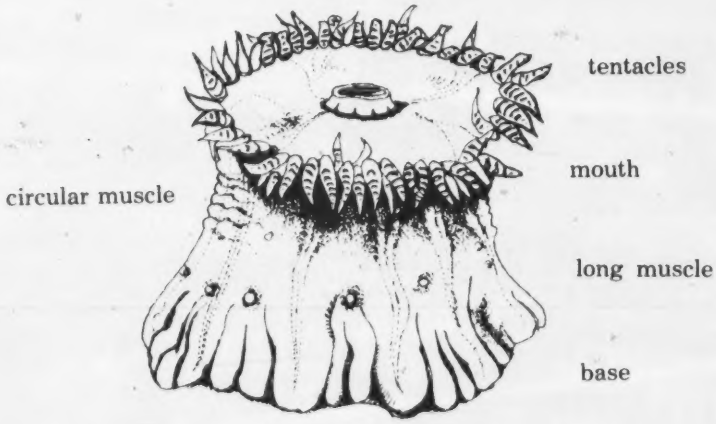


Hermit Crab out of Shell

Have you observed a snail's shell scurrying about at more than a snail's pace? Most likely this is the adopted'' home of a hermit crab, a comical little animal that lives in the discarded shells of others. Equipped with several pairs of walking legs and two front pincer claws, it scavenges along the bottom and climbs rocks in search of delicate morsels from the sea.

At certain times of the year the hermit crab molts, losing its hard outer skeleton as its body grows. A large crab requires a larger shell. The transfer to a new home is particularly exciting to watch in an aquarium. Just find an empty shell that is slightly larger than the crab's present one. Place it in the aquarium, and your pet will change shells when it is ready. This will often be in a matter of minutes.

SEA ANEMONE

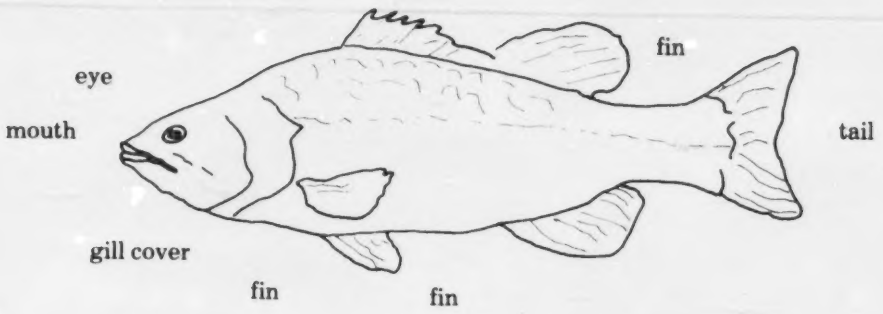


Anemones are the ''flower'' animals of the ocean. Tentacles surrounding the mouth open like petals and contract when danger threatens. They contain stinging barbs which temporarily paralyze their small prey and permit digestion to begin externally. They take in food and dispose of wastes through a single body opening.

Some anemones are carnivorous. There are some that collect particles of food from the water while others must have food placed in direct contact with their tentacles. Acceptable diets consist of fresh or frozen shrimp, crabs, mussels, or fish meat. They should only be fed when all of the tentacles are out. Uneaten food should be removed from the aquarium.

Some anemones are capable of swimming. Others depend upon a muscular disc on the bottom of their bodies to creep over rocks and sand. This disc also enables them to ''hitch-hike'' on shells of other animals.

FISH



Fishes are animals with backbones that live in the sea. Fast-swimming fishes usually swim by undulations of the body; most slow-moving forms move principally by moving their fins.

In most fishes the water (in which oxygen is dissolved) is pumped in at the mouth by movement of the bony gill cover and flows out across the gills. The fish can regulate the rate of flow by opening and closing its mouth.

Fish are vulnerable to physical handling, changes in water temperature, and salinity. Rapid gill pulsing and sporatic body movements may be signs of stress.

Different fishes feed in a variety of ways. Some, such as blennies and hogchokers, scavenge and scrape the bottom for small morsels. Others capture their prey alive while swimming near the surface.

A FINAL WORD

The first section of the unit will be the most difficult if both you and your students are setting up a saltwater aquarium for the first time. Don't shelter your students from the frustration of learning by trial and error or from the joy of successfully mastering a real problem. Although children of the primary grades may not be able to verbalize some of the physical properties involved, active intellectual and physical involvement in the experience of setting up a saltwater aquarium together in the classroom will provide the basic experience upon which formal definition and principles can be built when the child is ready.

BY THE END OF THIS UNIT YOUR STUDENTS SHOULD BE ABLE TO DO THE FOLLOWING:

--Cooperate within groups

--Show an ability to follow directions in removing and replacing marine animals in the aquarium

--Keep verbal or pictorial records of observations and inferences

--Group the living things in the aquarium according to a single property and according to more than one property

--Name three observations and two inferences about an aquarium animal

--List five observations that would make them think that something is alive

--Name five or more things that something alive needs

Congratulations for deciding to place a marine aquarium in your classroom! With it the world of saltwater will add another exciting dimension to your class's studies.

CALENDAR

ESTIMATED TOTAL TIME FOR UNIT APPROMINATELY 3 - 4 WEEKS

SECTION (Estimated Time]	INSTRUCTIONS	WHEN
Pre-unit Activity	ORDER FILMS (SEE APPENDIX C) AND BOOKS NOTED AT END OF SECTIONS	2 - 3 months prior to beginning unit
	READ INTRODUCTION: GATHER MATERIALS FOR SECTION I	
Section I, Activity #1 (5 min. per day for 1 week)	Do Activity #1 of Section I, Observing and Asking Questions	1 Week prior to starting Section I, Activity #2
Section I, Activity #2 (2 or 3 30-min. periods)	Do Activity #2 of Section 1	
Art and language art activities (2 or 3 30-min. periods)	Do activities	While tank is stabilizing (2 -3 days)
	BUY OR COLLECT MARINE SPECIMENS	1 day prior to starting Section II
Section II (3 or 4 30-min. periods)	Do all activities of Section II	
	DO NOT FEED ANIMALS: DUPLICATE WORKSHEETS FOR SECTION III	2 - 3 days prior to Section III.
Section III (3 30-min. periods)	Do all activities of Section III	
	COLLECT MATERIALS FOR SECTION IV: DUPLICATE WORKSHEETS	2 days prior to Section IV
Section IV (3 30.-min. periods)	Do all activities of Section IV	
	COLLECT MATERIAL FOR SECTION V (INCLUDING RECORD-FILM)	2 - 3 days prior to Section V
Section V (1 or 2 30.-min. periods)	Do all activities of Section V	
	PURCHASE BRINE SHRIMP EGGS FROM PET STORE	1 day prior to Section VI
Section VI (3 30-min. periods)	Do all activities of Section VI	Allow 2 - 3 days for hatching
	COLLECT OR PURCHASE FOUR NEW MARINE SPECIMENS	1 day prior to Section VII
Section VII (Evaluation) (3 3 30.-min. periods)	Do all activities of Section VII	

SECTION I

SETTING-UP

Processes: Observing
Inferring
Experimenting
Measuring
Predicting

Content: Setting up a saltwater aquarium

Behavioral Objectives:

The student will be able to:

--name five needs of living things found in water
--measure salinity and temperature of the aquarium water.
--describe and state the functions of the aquarium equipment

Teaching Tips:

Section I is an introduction, intended to arouse interest and inquiry into the marine environment; it is not intended to provide "answers." The answers will come later. The concepts introduced will be further explored in subsequent lessons, so don't insist on correctness. Give your students the opportunity and freedom to explore possibilities.

Alternatives for Larger Groups--

For groups larger than fifteen students (and if funds are available) two ten gallon tanks work well. However, if this is not possible, one large gallon jar can be used (these can often be obtained free from restaurants or school cafeterias along with an aerator (consult your local pet store for specific equipment.) Bimonthly water changes of one quart might be necessary if you use such small containers; however, certain animals such as snails and crabs can be used to provide natural filtering and to avoid frequent water changes. Do not place more than two small animals (such as a snail and starfish or a crab and a sea urchin) in each small container. Larger populations may die from an accumulation of wastes.

- goldfish in a bowl
- leafed potted plant
- jar of any size
- shoe box
- plastic container
- pencil box
- ten gallon tank (glass)
- subgravel filter, with airlift columns
- air pump
- 2 air stones
- three-way valve
- air line tubing (3 ft.)
- gravel (2 lbs/gal)
- small saucer or bowl
- three styrofoam cups
- artificial sea water salts for 10 gal. tank
- four plastic drinking cups
- cup of dirt
- strainer or stocking
- hydrometer (plastic ones are safest)
- thermometer

The thermometer and hydrometer might be borrowed from a high school chemistry class.

Activity #1

TO BE DONE ONE WEEK PRIOR TO SETTING UP THE SALT WATER AQUARIUM

Animals

A. Begin this activity one week prior to setting up the tank, allowing students time each day to observe changes in the water through feeling, seeing, and smelling. This extended exercise introduces the need for filtering wastes from the water in the aquarium. Have your students place fresh water in a bowl and allow it to stand for 24 hurs. Then place a goldfish in it. Feed it once a day with fish food. Don't change the water in the bowl during this time so that wastes and excess food can accumulate and become visible. The following questions should be asked on several consecutive days:

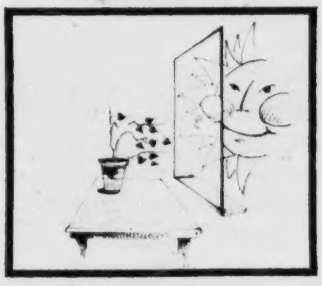
Would you like to drink some of this water now?
Is the water the same color as it was the first day?
Does it smell the same?
How does it feel?
What do you think would happen to the water if we put four fishes in the bowl?
If you were the fish, what would it feel like to swim in dirty water?
Can you think of some ways that we could keep the water clean rather than dirty?
What would be a good name for our goldfish?
One that describes him?
ex. "Scales", "Finny".

The goldfish might also be used later in this unit to point out the idea that fish are different; some live in fresh water, like lakes and rivers and some live in the salty water of the ocean.

Plants

B. The purpose of this exercise is to encourage more careful observation of the needs and behaviors of plants as living things. Since plants do not actively scurry about or eat baloney sandwiches, young children often have difficulty deciding whether they are alive. Plants have basic needs and exhibit very subtle behavioral responses. One of the more easily demonstrated responses in plants is their movement toward light.

Have your student place a small leafed potted plant on the window sill. Leave it in one position so that the leaves have time to turn toward the light. Then turn it so that the leaves are away from the sun and observe for several days.



Activity #2

SETTING UP WHAT DO OUR OCEAN FRIENDS NEED TO LIVE IN OUR CLASSROOM?

Holding up the goldfish in a jar, begin the lesson.

If we wanted to keep some of "Scale's" friends from the ocean in our classroom, could we just put them on our desks and take them to the playground with us like a puppy or a kitten?
Why?
What do we need in order to make a home for our friends, like "Scales?"

Make a list on the board of all the students' suggestions. Accept all responses, reasonable or otherwise.

Is there anything else?

(This list will serve to inform you about what the children know as well as about any mistaken ideas they may have about the marine environment. Analysis of the list should come later).

Can you act like a plant?
If you were a plant, how would you act if the sun were shining on you?
In a dark room?
What would it feel like to be a plant?
How would you feel if someone forgot to give you water?

Selecting a Home

Place several containers (such as a jar, shoe-box, coffee cup, pencil box, and a clear plastic cup) in front of the class and ask the children which would make the best home for a fish.

Why?(List as many as you can get.)
What might be a better one?
Why? (List all).

Bring out the glass tank and ask if it would be okay.

In what ways is this better than the other containers?
(Again list as many answers as you can get.).

As answers are given, be sure to ask "why" in order to understand the children's reasoning. They might all be focusing on a specific variable. You might help direct their attention to another possibility. (i.e. Which container would be best if we want to watch the animals?)

Have your students decide on a place for the tank which meets the criteria discussed in the introduction on page 3. Have your students place the tank in the appropriate setting and check for leaks (page 1 of the introduction).

Have your students assemble and place the filter and aeration system in the tank as described in the introduction on page 2. If your students want to know what it is for, ask them possible uses. Then say that that you will come back to its function later.

Air

"Let's look back at our list.

Is there anything that we must do before we put something alive in here?

Ask the children to hold their nose with their hand over their mouth for ten seconds.

Do you have trouble?
Why?

We need air--new air in and old air out. This is how we breathe.

Is the goldfish breathing?
How do you know?
Do you know for sure?

Point out the movement of the gills and the mouth.

Does this mean that the fish is breathing?
Could it be doing something else?
Eating or drinking perhaps?
Where does new air get into the water?
Where does old air get out of the water?
Does water on the bottom get as much air as water on the top?
What could we do to make sure that all the water in the tank gets up to the air?

Hook up some connecting tubing to the pump; plug it into the wall socket and hold the tubing on the surface of the water.

What happens to the water?
Do you hear anything?
What do you see?

Attach the airstone to the end of the connecting tubing.

What happens to the water now?
What do you hear?
What do you see?
Are the bubbles the same?

Assemble the airstones in the tank by connecting them to the air lift columns and inserting the columns in the subgravel filter. (See diagram in equipment section of introduction).

Gravel Preparation

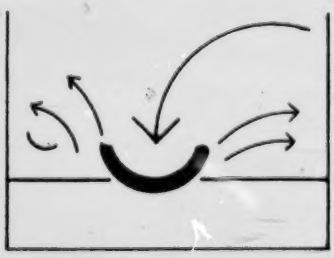
If we were to take a walk on the seashore, what might we walk on?
So that our aquarium is more like the fishes' own homes in the ocean, can you think of something that we could put on the bottom of our tank?

Have your students rinse the gravel with tapwater several times until the wash water is no longer cloudy. Do not use soap or any other type of cleaner. Let the students scoup cupfuls of gravel and carefully place them into the tank until there is an even three inch layer over the subgravel filter.

Can you think of an animal that might like to live in the sand and gravel?
Why?
How do you think that it might move?
How would you feel if you lived in the gravel and sand?
How would you get your food?

All of these questions will be explored more later. They are introduced here in order to stimulate thinking, personal feeling, and careful observation of the creatures that will be living in their classroom aquarium.

Water



In order to prevent stirring the gravel while pouring in water, place a bowl on top of the gravel in the tank. Have class members pour the tap water into the bowl, allowing it to overflow until the water level is approximately 5 cm (two inches) from the top of the tank. This is a "working" aquarium and this space allows room for the children to remove animals and plants without the tank water sloshing out!

Fill one cup with tapwater (A) and one with a mixture of ¼ cup artificial salts and water (B) (label them Cup A and Cup B).

Let each of the students dip a finger into each container and ask them the following questions:

Do they taste the same?
Would you like to drink, bathe, or cook with Cup A or B?
Why?
How could we make Cup A taste like Cup B?

Another way to distinguish the difference between tapwater and ocean water without tasting it is with a hydrometer. Place an hydrometer into Cup B and ask the students to read the water line on the hydrometer. Repeat by placing the hydrometer into Cup A. If the cup is not deep enough to allow the hydrometer to float, try a quart jar.

Does the hydrometer read the same?
Why?

Place the hydrometer in the ten gallon tank.

What does the hydrometer read?
How can we make the tap-water in the tank the same as the water in the cup?
(If the students add salt without stirring call their attention to it.)
Where is the salt?
Where do you want it?
Why should we stir the water?
Can you think of another way that we can make the salt disappear?

If the water level goes beyond the desired level on the hydrometer, give the children a chance to figure out how to correct it.

Optional:

What does the hydrometer measure?
What would happen if we added sugar to the water?
How did we know to add salt and not sugar to make sea-water?

Wastes

"Why do we flush the toilet when we use it?"

If there are other animals in the room, discuss their wastes. Holding up the bowl of goldfish, discuss the need for waste removal calling attention to the goldfish in the bowl.

"Where are the wastes?"
Can you see them?
If you were Scales, would you rather swim in clean water or dirty water?
How would it feel to swim in dirty water?

Living things in our aquarium like to live in clean water.

How can we make the water clean?
Do you think that living things in the rivers and in the ocean have wastes just like you and I do?
Where do the wastes in the rivers, lakes, and ponds go?

Teacher Demonstration:

Mix a small amount of dirt in ½ cup of water within a plastic cup. Pour ½ of the dirty water through a strainer lined with cotton, catching the filtered water from below in a clear container. Repeat as often as necessary in order to filter the water.

Which water would you like to drink?
(Show the original remaining cup of dirty water next to the filtered water).
Why?
Which do you think is cleaner?
Why?
Where did the dirt go?

After this demonstration ask your students how this system might help to purify the water. Then if necessary, point out that the gravel and the subgravel filter trap the wastes in the aquarium just as the cotton in the strainer trapped the dirt. This is just another way to make the water clean. Start the pump and adjust the air flow with the three-way valve so that the bubbles break evenly at the surface. (See diagram in equipment section of introduction.)

Temperature

Arrange three cups of water marked x, y, and z (very cold, cool and very warm). Ask the children to dip a different finger into each.

Prepare two cups of water that are closer in temperature.

Ask several children which is colder. How did you find out?
Do you all agree which is colder?
Which is right?
How can we find out?

When we say that something is hot or cold we are talking about the temperature. Show the class the thermometer.

Have you ever seen a thermometer before?
Where? When?
How is it used?

Place a thermometer in a cup of ice water and then place it in hot water.

What happens?

A thermometer is another way to find out if something is hot or cold. It is a way of finding out exactly what the temperature is.

Is the ocean hot, cold, or cool?
Why?
Would you like to swim in the ocean if it were hot?
Why?

Teacher Tip:

This would be a good place to teach the skill of scale reading using a thermometer. It may best be done with individuals or small groups over time.

Fish cannot put on and take off an overcoat like we can, so we want to be sure that we keep the temperature at a level at which they survive best. Draw a thermometer on the board. Fish like to live in water whose temperature is between 15°C (60°F) and 25°C (77°F). The gray line in the thermometer indicates the temperature.

What number does the water in the tank read?
Is it between 15°C (60°F) and 25°C (77°F)?
In setting up the tank what should we do if it reads 30°C?
(86°F) or 10°C (50°F)?

If the children suggest adding hot or cold water, ask:

What will it do to the saltwater in the aquarium?
How could you find out?

List student's suggestions and try some of them.

Food

What shall we feed our friends from the sea?
Can we give them the same things that we eat?
Hamburger? French Fries? Why?
What do you think that animals from the sea like to eat?

We'll find out this and much more in the weeks to come.(See introduction on caring for marine animals.)

ENRICHMENT ACTIVITIES

Art Activity

A. Make stuffies (3-D animals of cloth or construction paper) of who is coming.....

- construction paper
- stapler
- cotton
- string
- crayons
- tree twigs or fallen branches

Have your students cut out duplicate shapes from construction paper of their favorite marine animal. Staple together leaving a 1'' hole at the top for inserting cotton stuffing. Staple hole, attach string. Assemble as mobiles or hang on limbs of an old fallen tree branch.

B. Next week we will add some of our water friends to their new home.

Who is coming?
Can you draw the animals you think will come live in our aquarium?
Why not Scales?

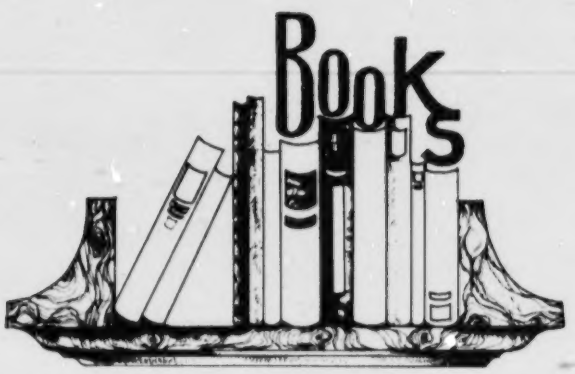
Scales is a fish that lives in fresh water like the lakes and rivers. He does not live in the ocean. Discuss the difference between lake waters and ocean waters. A freshwater plant might be placed in saltwater and observed; however, do not put scales or any other freshwater animal in salt water. Discuss why this is a good place for a values discussion.

Language Arts

Make a poster of the aquarium.

- poster
- construction paper
- pins

Make word labels for parts of the aquarium which can be pinned on. As a new plant or animal arrives during the unit, add a new word sign and picture of the plant or animal.



Behrens, June. **LOOK AT THE SEA ANIMALS.** Children's Press, 1975.

Gouday, Alice. **HOUSES FROM THE SEA.** Charles Scribners Sons, 1959.

Lionni, Leo. **THE BIGGEST HOUSE IN THE WORLD.** Pantheon Books, Inc. 1968.

Lionni, Leo. **FISH IS FISH.** Pantheon Books, Inc. 1970.

Morse, Doug. **THE SEA BOOK.** Story Fold, 1974.

Addresses of book companies found in Appendix D.

THE OCEAN: A FIRST FILM. BFA. Color. 11 minutes.

MY WORLD . . . WATER. Churchill Films. Color. 11 minutes.

A DROP OF WATER. #A119. Barr Films. Color. 14 minutes.

YOUR FRIEND THE WATER - Encyclopaedia Britannica. #814. Color. 6 minutes.

Available from distributors with two months notice at slight rental fee.

SECTION II

OBSERVING MARINE ANIMALS

Process: Observing

Content: Marine Animals and Plants (if available)

Behavioral Objective:

The student will be able to distinguish things that are the same from those that are different on the basis of a stated property such as shape, color, size, movement, and texture.

Teaching Tips:

The introduction of animals and plants into their new home is an excellent opportunity for observing their differences as well as their similarities. The sea urchin, starfishes, crabs, and snails can be handled gently and removed from the water for a short period of time (up to five minutes) if necessary. The shrimp and fishes are considerably more delicate, however, and should not be handled at this time by the students. Give the students plenty of time for observing, "messing about", and experiencing their new water friends.

Remind the students before and during the lesson that the animals must remain in the water at all times unless carefully supervised by you. The children can touch them very gently and briefly to sense what they feel like and to watch their behavior. Ask how they would feel if someone kept poking them and dunking them in the water.

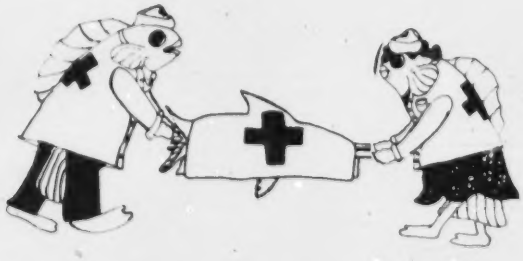
How should the observing be done?

Plants may be removed from the water for a period of time not longer than one hour.

Handling the Animals

Handle the animals with nets whenever possible. When doing hands-on activities, be sure students rinse their hands with water before touching the marine organisms. Be sure they rinse their hands thoroughly. If you take water from the aquarium for such activities, replace it with new artificial sea water. See the introduction for notes on animal care.

Death in the Aquarium



Death is a natural occurance. When it occurs, discuss it. Let the students touch the animals and observe the changes after death.

Remove dead animals and plants from the aquarium as soon as they are noticed. They decompose and release waste products that upset the nutrient balance of the aquarium. Large natural bodies of water such as rivers, lakes, oceans, and streams can absorb these wastes; however, smaller aquariums cannot.

Definitions

The distinction between an observation and an inference is often confusing. An **observation** is a description that is perceived through the five senses of sight, hearing, touching, smelling, and tasting. This includes measuring.

The starfish creeps along the glass.
The water is clear and cold.
Our aquarium is in the back of the room.
The crab makes a scratching sound as it walks along the glass tank.
The earthworm is ten centimeters long.

An **inference** (guess) involves a judgment or conclusion as a result of one or more observations. It involves suggesting explanations or causes of events that have occurred.

The water is fishy because there were fish in it yesterday.
The starfish is not hungry because it did not eat my sandwich.
The white powder is sugar.
The crab likes to be held.

If an animal moves toward food, you might infer that it is hungry. You don't know for certain. You are only observing a crab moving toward food. Inferring as a skill will be the subject of Section III.

materials

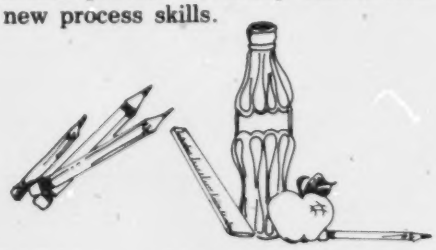
- pencil or other familiar classroom object
- goldfish in bowl
- potted plant (from Section I)
- 4 wide-mouthed containers (5 - 6" deep) Clear jars or plastic food containers work well as long as they are thoroughly cleaned
- animals and saltwater plants: (starfish, sea urchin, crabs, snails, shrimp, blenny) are sometimes available from an aquarium supply or a pet store. See page 4 of the introduction for hints on buying animals and Appendix B for a list of marine life suppliers
- magnifying glasses
- flashlight
- rulers
- food for the animals
- black and white construction paper
- playdough
- rocks, shells, sand, etc. for decorating
- playdough animals
- toothpicks

Activity #1

OBSERVING

New process skills are introduced by first allowing your students to manipulate very familiar objects. Unfamiliar objects and live animals provide too many distractions and are more effective after the students have practiced their new process skills.

Something familiar



Hold up a familiar object such as a pencil and ask some of the following questions in order to encourage careful observation:

Can you find something in the room that is the same color as the_____?
Will the_____fit through the keyhole?
Can you find something that feels like the side of the_____?
Can you find something that feels like the edge of the_____?
Is the_____more than three centimeters long?
How can we find out?
Is it longer than your finger?
How can we find out?
What else can you observe and tell me about thi____?

Define what an observation is. All of these clues that we have been giving are called observations. An observation is a clue or a description that we know by using our senses.

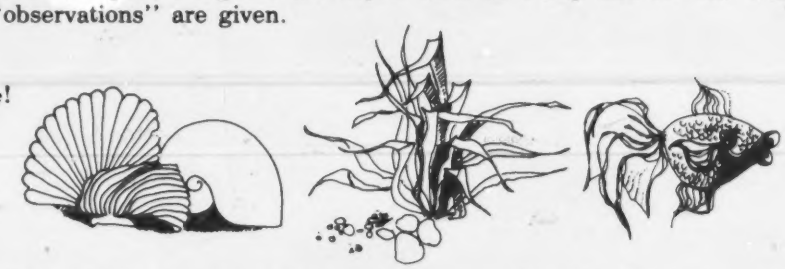
How do we know that water is fishy?
The birds are chirping?
Or that the sky is blue?
Do we know for sure?

When we use our eyes, our fingers, our nose, our tongue, or our ears to say something about an object we call it an observation.

Can you make an observation about_____?
Repeat in order to drill the word.

Sort out the observations from the non-observations about the object above. As a class make a list of all students' statements. Repeat using another object such as a cup and let the students sort as the statements of "observations" are given.

Something alive!



Using the goldfish and the plant from Section I encourage the skill of observation by asking general questions to the class.

What observations can you make about Scales?
About the plant?

Goldfish

Can you find something in the room that is the same color as the goldfish?
Can you find its arms, tail, and mouth?
Are any of them moving?
Do they always move?
Does the fish like to stay in one place?
Does it ever bump into the side of the jar?
Have you seen it eat?
How does the fish jar smell?
Would you like to drink a whole glass of the water that the fish is swimming in?
Why?
Do you hear any sounds when the fish swims along the bottom?

Plants

What color crayon would you use to draw the plants?
Are all of the leaves the same color?
Can you think of something else that feels just like the leaf feels?
What feels smoother or rougher than the leaf?
Have you seen the plant move?
Does it move like the goldfish?
Does the plant always face the same way?
Why?

List all of the responses on the board. Observations are clues that we know by using our senses.

Which of these are observations?
Why?
Which sense did you use to make each of your observations?
What do you think would happen if we put a leaf in tap water?
In salt water?
Why?
(Try it and let the students observe and infer why certain things happen.)

Activity #2

OBSERVING MARINE ANIMALS

Divide the class into four groups and have them seated around different tables. Give each team a name which they will keep throughout the unit. Consistent grouping as well as a team name might serve to inspire some group identity.

The animals must remain in the water at all times unless supervised by you.

For each group of students, prepare a small clear wide-mouthed container with a thin layer of transporting water and ¼" of aquarium water. While the students are doing this activity, you will be gradually acclimating the animals by adding a small amount of aquarium water (¼ cup every ½ hour for one hour) to the individual containers.

Let's examine some of our friends before we put them into their new home. Place an animal or plant at each table in the prepared dishes of water and ask the general questions first in order to focus their observations on specific things such as movement, texture, color, and shape. If necessary ask more specific questions.

List as many observations--things you can perceive by using one of your senses--as you can about your organism.

How many can you find?
What does it feel like?
Does it have skin like ours?
Can you think of anything else that feels like the_____?
How does the_____move?
Does it ever stop moving?
Can you find the feet?

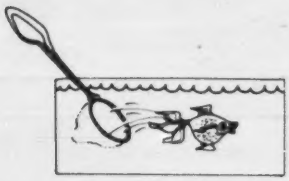
Rotate the animals among the groups so that each group will have a chance to observe each specimen for ten to fifteen minutes. If necessary this activity may take more than one day. In the meantime animals should be placed in the aquarium by your students according to the procedure described in Activity #3. Give the students enough time to observe and become familiar with the different animals and plants. The objective is to develop the skill of observation by focusing their attention on the animals and plants. Ask questions that will stimulate them to investigate.

How are the_____and the_____alike?
How are the_____and the_____different?

Activity #3

COMPARING OBSERVATIONS

Supervise the placing of the animals and plants in the aquarium. (Dip the container with the animals into the aquarium sideways and let the animal or plant flow out with the water.)



Allow the students time to observe all of the animals together in their new home.

How are the animals the same?
Different?
Are any of them the same color?
Do any of them move in the same way?
Do any of them stay in one place more than another?
Do they ever seem to fight?
Who seems to win most often?

Which of these statements are observations?
Which are not?
Why?
What sense did you use for each of your observations?
Would you bet your lunch that your observations are ture?
Why?

Activity #4

SUMMARY--A POTPOURRI

In order to reinforce some of the students' observations and to encourage them to transfer the process of observation to things outside the aquarium, ask several children the following types of questions:

Seeing

I am thinking of several things in the room (it does not have to be in the aquarium) that are the same color as the grass.

Can you find them?

Do any of the animals look the same on the top and the bottom?
How are they the same?
How are they different?
Can you make a drawing on the board to show how the hermit crab tracks might look in the sand?

Touching

Can you find something that feels like the starfish?
Does the plant feel like any of the animals?

Moving

Can you pretend to walk like a hermit crab?
Can you make a sound like a crab walking on glass?

These questions are suggestions; feel free to add to them. Continue throughout the week with questions of this kind in order to encourage and to drill the process of observation.

Activity #5

ATTITUDE AWARENESS

Attitude is a vital part of this unit. This is not an optional lesson. Whenever possible ask questions similar to those that follow in order to stimulate discussion about feelings, responsibilities, and experiences. Remember, student comments are to be accepted without criticism or value judgments.

Which animal would you most like to be?
Why?
What would it feel like to be a fish?
Can you move like a goldfish?
What would it feel like to be a fish out of water?
A fish without food?
Why is it nice to have a fish in our room?
Can you act like a plant?
What would it feel like to be a plant?
What would you feel like if you were a plant and the waves got very rough in the ocean?
What will we do to take care of the plants and animals in our aquarium?
What do we have to do to take care of their friends who are still in the oceans?

Optional Activities

OBSERVATION GAME

One person in the class is sent out of the room. As a group, the class decides on an object in the room. When the person returns to the classroom he/she tries to guess the object from clues (observations) given by members of the class. The class must be alerted to watch for non-observation statements. The object of the game is to guess the object in as few clues as possible.

Repeat two or three times with different children leaving the room. This exercise can be done during any free moments during the day.

B. OBSERVATION DRILL

Directed to the class, hold up an inanimate familiar object (chalk, eraser, pencil) and ask for observations about the object.

Repeat using an inanimate unfamiliar object such as tea, instant breakfast, baking soda, or brine shrimp eggs (available from pet store). Encourage your students to use all of their senses in making their observations. Encourage measuring whenever possible.

Repeat using animals from the aquarium. If a child makes a non-observation, be sure to ask if he knows for sure.

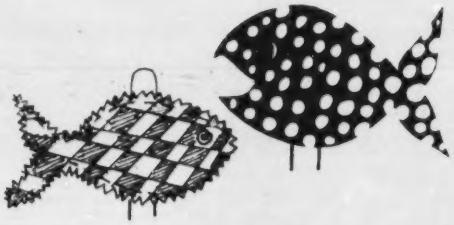
C. SHAPES AND SIZES

Ask the students to mold the shape of their favorite animal or plant out of playdough. Your role during the art portion of this activity is to ask students how they could make their objects look more like the animal in order to encourage closer observation. Other members of the class try to guess the animal from the shapes.

Can you think of anything else that has the same shape?
Are all of the animals in the aquarium the same shape?
Are they all the same size?
How can you make the playdough animal larger?
Smaller?
Can you make it feel like the sea urchin? Starfish? Fish?

ENRICHMENT ACTIVITIES

Art Activity
Puppets of Aquarium Animals



- Construction paper
- stapler
- cotton
- sticks (twigs and fallen branches from a tree work well)
- sand, shells, crayons, or paint for decorating the outside of the puppets

Have your students draw and cut duplicate shapes of their favorite aquarium animal out of construction paper.

How can we make our stuffed animals look and feel like our real aquarium animals?

Staple around the edges of the shapes, leaving a two inch hole on the bottom for stuffing with cotton and inserting a stick.

Language Arts

As a class your students should compose a story, orally or pictorially, about some of the animals that they have observed in their aquarium.

Freedman, Judy. **THE EEL'S STRANGE JOURNEY.** Thomas Y. Crowell, 1976.

Hornblow, Leonora. **FISH DO THE STRANGEST THINGS.** Random House, 1966.

Morris, Robert. **DOLPHIN.** Harper and Row, 1975.

Schwartz, Charles and Elizabeth. **WHEN WATER ANIMALS ARE WET.** Holiday House, Inc. N.Y., 1972.

BEACH AND SEA ANIMALS - Encyclopaedia Britannica. Color. 19 minutes.

BY THE SEA. Arthur Barr. Color. 14 minutes.

FISH--A FIRST INQUIRY. BFA. Color. 9 minutes.

LAND and WATER CRABS. MacMillan. Color. 19 minutes.

OTTERS--CLOWNS OF THE SEA. Paramount Oxford. Color. 19 minutes.

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SECTION III

(DO NOT FEED THE ANIMALS TWO DAYS PRIOR TO THIS LESSON)

INFERRING ABOUT MARINE ANIMALS

Process: Inferring

Content: Marine Animals

Behavioral Objectives:

The student will be able to:
--Make inferences about living things
--Distinguish between an observation and an inference
--Cooperate within groups

Teaching Tips:

This lesson teaches what an inference is. An inference is a judgment or conclusion involving the suggestion of explanations, reasons, or causes of events which have occurred or might occur. It is usually the result of careful observation. This lesson also provides practice for the students on the distinction between an observation and an inference using very familiar inanimate objects first, and eventually progressing to a more complicated situation of using live animals.

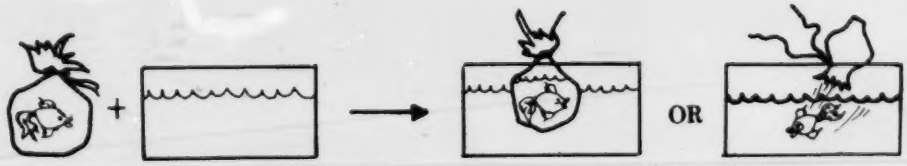
The teacher's role involves asking testable questions whenever possible. The students should manipulate and observe the behavior of the plants and animals in order to make their inferences.

Protecting Your Specimens From Shock

Since you do not want the animals to die, remind your students how they would feel on a hot day if someone ducked them into an ice cold pool.

How can they change the temperature of the water very slowly and measure it?

You might suggest placing their container inside another container filled with water of a hotter or colder temperature.



The animals must remain in the water while the students learn about them. Why is this important? Plant and animal behavior is best observed in conditions most closely resembling their natural environments.

- four small sealed boxes containing any small object in each (such as a tack, rock, pencil, sand)
- 4 wide-mouthed clear containers (5 - 6" deep)
- flashlight
- ice and hot water
- magnets
- variety of fish food and saltwater plants (available from pet store)
- colored construction paper

Activity #1

SOMETHING FAMILIAR

Using the same familiar objects as those of Section II, ask the following kinds of questions in order to stimulate inference-making:

What might this be used for? (Ask for several suggestions.)
Which is right?
What is this made out of?
Do you know for sure?
Where did they come from?
Do you know for sure?

Activity #2

MAKING INFERENCES

Having prepared a sealed box containing an object unknown to the children ask the following questions:

Is object_____bigger than the one in the box?
What do you think?
Do you know for sure?
How can we find out?

Repeat with several other boxes. Drill is needed on the difference between what they know for sure (observations) and things that they think are true (inferences).

Can you guess what shape the object is?
Is it harder than this table?
Is it red as the flower in the picture?
Can you guess what is in here?
(Ask for several guesses.)
After each response, ask if they know.
How could we find out?

Definition:

When we guess or think that something is true about an object but don't know for sure, we call this an inference. By asking the following kinds of questions you provide drill for the word and process of inferring.

Can you make an inference about what_____could be used for?
Where did it come from?
What is it made of?

Repeat with several objects.

Do you know for sure?
How could we find out?

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Distinguishing Observations from Inferences:

Can you make some observations about the aquarium?
Can you make some inferences about the aquarium?
What would happen if I turned off the pump?
Is that an observation or an inference?
Do you know for sure?
Can you make an inference about what would happen if the temperature got very cold in the aquarium?
Do you know for sure?

Activity #3

MESSING ABOUT AND MAKING INFERENCES

Divide the class into the groups established in Section II. Let one person from each group remove an animal from the aquarium and place it in a wide-mouthed container with enough aquarium water to cover the animal. Place the containers on the tables, as before.

Ask the class some general questions in order to stimulate investigation.

Do the animals that live in the aquarium like the things that you and I do?
Do they like the cold?
Do they like the warmth? (Upper limit 26°C or 80°F)

Let each group find out if the animal at their table likes the cold. See safety note on preventing shock in the teacher tips of this section. Direct questioning to the entire class in order to focus the individual group activities on the same topic.

Do you know for sure if it likes the cold?
Could it be moving away from or toward anything else?
Do all animals do the same thing when we put them in cold water?
Do they all like the light?
How can we find out?

Let them try different ways of finding out.

Do we know for sure?

Hand out duplicates of the data sheet which appears at the end of this section. Have the students write the name of their animal in the large space at the top as you print the words on the board. This sheet should be used to record results. The left column indicates (by picture or words) what their stimulus was. The facts indicate whether their animal liked, disliked, or was indifferent to what they did. The students should place an X in the appropriate box.

Review what happened and how they should record it on the chart. Continuing in their groups, your students should find out as many things about their animals as they can. While second grade students may only be able to mark the faces, third grade students may be ready to write what the animal actually did. Remind them that they must do something to find out; otherwise they are guessing and making inferences without data.

Activity #4

SUMMARY

Make a chart on the board and list some of the things that the students know about each of the animals.

Which things do we know for sure?
Which ones wouldn't we bet our lunch on?

Place an I next to all of the things that they are not sure of and an O next to those statements that they are sure of.

What are these statements called?

The words "observation" and "inference should become familiar to the students. Emphasize them whenever possible.

STARFISH	CRAB	SEA URCHIN
Creeps along sides of glass		
likes light		
eats algae		
smells fishy		

Activity #5

DRILL

Make several statements and ask the class to state whether each is an observation or an inference:

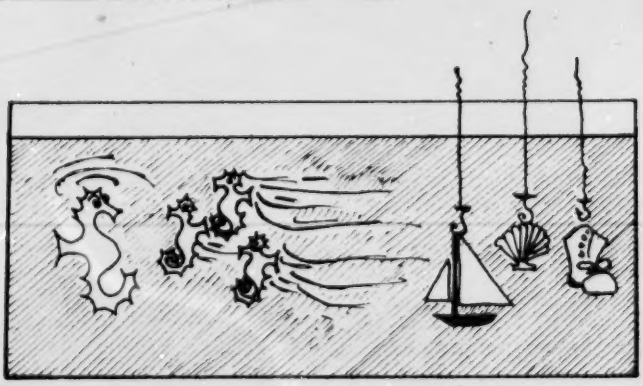
_____is wearing a red dress.
The aquarium is fishy.
My cat likes to lick herself.
The teacher next door is sitting at her desk.
The sea urchin has spines.

Have the class make as many more observations and inferences (labelling each) as they can about the other animals in the aquarium.

How do the animals behave?
Do they like to stay in one place more than another?
Do they ever seem to fight?
Does the hermit crab use all of its legs when walking?

Put some new object in the aquarium....

Does the_____react to the new object (rock or shell?)
What does the crab use to hold its food?
How long does it take the starfish to suck its food in?
How is the_____like the_____?
How is the_____different from the_____?



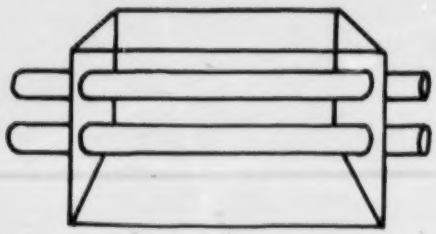
ENRICHMENT ACTIVITIES

Art and Language Arts Activity...

Our Underwater Film

- construction paper
- crayons or watercolors
- large cardboard box
- paper towel rollers (two)
- tape

Have the students draw pictures with crayons or watercolors of what they might see if they were one of the aquarium animals walking along the ocean floor. Tape all of the pictures together and attach them to a viewbox constructed of cardboard and paper towel rolls as diagrammed below.



Have each group make up a "sound track" to go with the "film strip" telling a story in the first person as one of the aquarium animals. If possible, have the students record the stories on a tape recorder and play it back to them.

cold			?
light			?
touch			?
			?
			?
			?
			?
			?
			?
			?

Name _____

38

Fay, Hermann. **MY SEA.** Hubbard Press, 1974.

Goldin, Augusta. **THE BOTTOM OF THE SEA.** Thomas Crowell,Inc., 1966.

Posell, Elsa. **TRUE BOOK OF WHALES.** Children's Press, 1963.

HOW ANIMALS MOVE. Holt/Ealing Part 1, 81-3212, Part 2, 81-3220.

SEA LIFE. National Geographic Educational Series, 5 Films 0372.

PLACES WHERE PLANTS AND ANIMALS LIVE. National Geographic Educational Series, 5 Films 03774

ANIMALS EAT IN MANY WAYS. Indiana Films. NSC 1456. Color.

SECTION IV

CLASSIFYING BEINGS'N THINGS

Process: Classifying

Content: Beings'n Things

Behavioral Objectives:

The student will be able to:

--Group things that are the same on the basis of a stated property
--Group things that are the same on the basis of more than one stated property
--Distinguish living from non-living things

Teaching Tips:

Classifying involves the arranging or grouping of objects or events according to a particular system. There are many ways of grouping objects; therefore, be sure to question your students in order to understand their basis of classification. As long as the objects or events conform to their designated basis for grouping, the classification is valid.

Preparation for This Lesson

Prepare four bags containing the same assemblage of eight objects in each. These may be any objects, not necessarily associated with the beach (pencils, erasers, or straws for example).

Print one copy of the worksheet at the end of this section for each child.

Be prepared to develop the concepts of the following as life-defining characteristics:

--moving (Activity B, Section I, showed that leaves turned toward sunlight)
--eating (plants--look up venus flytrap and share its eating habits with your students)
--reproducing
--growing
--responding to stimuli
--breathing

- four paper lunch bags containing eight objects in each (not necessarily related to the beach such as pencils, straws, erasers, etc.)
- worksheets
- ten slides or pictures of living and non-living things (available from nature magazines, National Wildlife Federation publications, or Virginia Institute of Marine Science)

Activity #1

GROUPING OURSELVES

Select four children from the whole class on the basis of one common obvious characteristic (ie. all are wearing red, for example) and place them in one group; pick two children without this characteristic and place them in another group.

Can you guess why these people are in one group and these people are not in the same group?

Repeat several times using different characteristics. If time permits allow some of the children to play the "teacher roll" in this activity.

Activity #2

GROUPING THINGS

Provide each group of students with a bag of eight objects. State a single property such as color, size, shape, or texture and ask them to place the objects into two groups according to that property. (i.e. It has some red or it has no red.) Repeat after stating another property. All of the objects must be used.

Ask the children to place the objects into two groups allowing them to determine the property.

Ask why they grouped them that way?
Can you put them into two other groups?
Why?
Which is the right way?

(Any grouping is acceptable if it is consistant with the student-stated criteria.)

Can you group the objects on the basis of two properties?

For example: All of the things in this pile are smooth and white while all of these in the other pile are neither. Repeat the above two excercises using two properties.

Can you group these things on the basis of three properties?
Repeat.

Activity #3

WORKSHEET EXERCISE

Distribute a copy of the worksheet which appears at the end of this section to each child. Ask the students to cross out the picture that does not belong in each horizontal row. Be sure to review and to ask why they crossed out a particular one.

How is the object different?

Accept valid reasons even if they are different from yours.

Activity #4

ALIVE OR NOT?

Ask the class to begin naming all of the things in the aquarium. As they name things, list them in two groups.

Can you guess why I put them into theses two groups?
(Group them into living and non-living)

They may see other reasons for grouping them; be sure to accept all valid suggestions.

"I am thinking of one way to group these things; however, there are many ways to group them. You have mentioned several. I have made a list to separate living things from non-living things."

Why did I put these things in the list of things that are alive?
What makes something alive?

Be sure to list all of their suggestions, correct and incorrect. Discuss and sort after all suggestions are in. Puzzle the children. Challenge both correct and incorrect statements. For example, if they suggest that living things move, you might mention that the ocean moves;

Have you ever seen a tree walking down the street?
Is a tree alive?
Why?

Call attention to the plants from lesson #1. Ask if they are alive.

Why?

Show ten slides or pictures of living and non-living things (marine oriented slides should be included along with more familiar plants and animals) and ask the children to state which is alive and which is not.

Why did you classify them that way?
Can you think of another way to classify them?

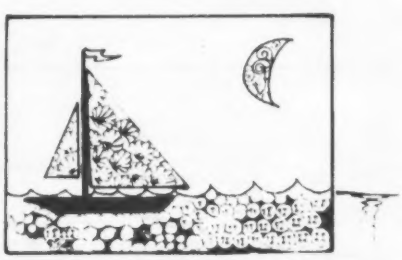
ENRICHMENT ACTIVITIES

Art Activity:
Classifying

materials

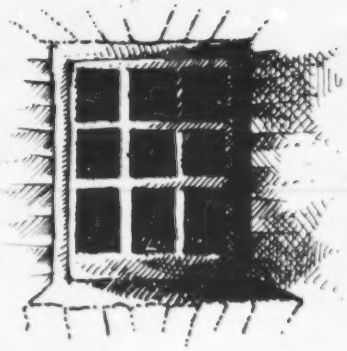
- small objects collected by the children from home (buttons, pebbles, sticks, paper, plastic caps for example)
- cardboard from boxes or scrap wood available from a lumber yard or collected at the beach
- Elmer's glue

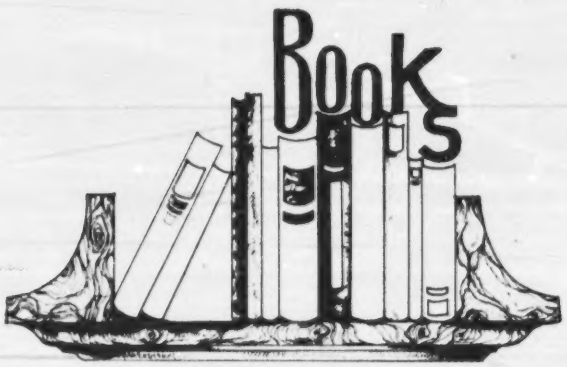
Small objects such as bottons, white beans, brown beans, popcorn, split peas, shells, pebbles, sticks, and paper are grouped and sorted by the children. Ask the students to construct a textured picture or design by pasting the objects on cardboard or wood as diagrammed below. Stress a repeated pattern and keep the pictures small to avoid boredom.



WORKSHEET

(See page 34)





Dickey, Albert. **ABOUT RIVERS.** Melmont Pub., Inc., 1959.

Ardizzone, Edward. **TIM TO THE RESCUE.** Henry Z. Walck, Inc., 1949.

Ardizzone, Edward. **PETER THE WANDERER.** Henry Z. Walck, Inc., 1949.

ANIMALS WITHOUT BACKBONES. Coronet. Color. 11 minutes.

THE BIOLOGIST AND THE BOY. NOAA. Color. 14 minutes.

BIRDS OF THE MARSH. Coronet. Color. 11 minutes.

UNCLE SMILEY GOES TO THE BEACH. Learning Corporation of America. Color. 12 minutes.

BIRDS OF THE SANDY BEACH. BFA. Color. 10 minutes.

WE EXPLORE THE BEACH. Coronet. Color. 10 minutes.

THE LIVING EARTH. Pyramid. Color. 9 minutes.

PUTTING ANIMALS IN GROUPS. International Film Bureau. Color. 13 minutes.

THE WORLD OF PLANTS. National Geographic Educational Series, 03784.

SECTION V

INFERRING ABOUT PARTS OF LIVING THINGS

Process: Inferring

Content: Parts of Living Things

Behavioral Objectives:

The student will be able to make inferences about parts of living things.

Teaching Tips:

The purpose of this lesson is to give the students a chance to relax and to reflect creatively on the experiences that they have had thus far. Play along with your students. Pretend to be a scavenger from the deep sea and share your "goodies".

- A non-verbal film that is visually and musically descriptive of the sea (suggested film: Deep Blue World, Pyramid Films)
- "goody bag" containing several parts of sea creatures (shark jaw, clam shell, crab claw, etc.) These can be obtained from a restaurant that sells seafood (except for the shark jaw
- pictures or photographs of the complete animal
- any record of sea sounds or chanties available from your local library

Activity #1

INFERRING AND COMPARING

Bring a "goody" bag filled with parts of several things from the sea and ask the students to draw what they think the rest of the animal might look like. While the students are drawing, you might play a record of sea sounds or chanties.

Emphasize the inferring nature of the drawings.

Which drawing is right?

Discuss a few drawings. Have the students give suggestions which are different from those that they drew. Provide pictures of the actual animals for the students to compare with their inferences.

Activity #2

IF A FILM AS DESCRIBED IS UNAVAILABLE

(or as an optional activity).

Have your students make an imaginary sea animal out of scrap materials. (Make one yourself as a demonstration.) Remind your students that they are not real animals and do not have to look real.

Have the students ask each other questions that will encourage their classmates to make inferences about the imaginary sea creatures:

Where do you think it might live?
Why?
How does it catch its food?
(What makes you think so?)
How does it move?
Why do you infer that?

Since Section V is entirely a creative expression lesson, no extra enrichment activities have been provided.

SECTION VI
PROBLEM-SOLVING

Processes: Observing
Inferring
Manipulating variables
Collecting and recording data

Content: Discovering Pirates' Dust (brine shrimp eggs)

Behavioral Objectives:

The student should be able to:
--Make inferences on the basis of observations
--Test inferences by manipulating one variable at a time

Teaching Tips:

For this lesson, the teacher might spark more enthusiasm if he/she dressed as an underwater detective or a pirate. The purpose of this lesson is to extend the child's investigation beyond the passive role of observing and inferring to a more active role in problem solving and record keeping. (Perhaps the students would also like to be pirates and make patches for their eye!)

Preparation for the Lesson:

Fold two sheets of white paper in half and staple them together in order to make a notebook for each student.

Helpful Hints:
Hatching and Maintaining Brine Shrimp

Brine shrimp are excellent animals to work with in the classroom; they are hardy, dependable, and change fairly rapidly through their growth stages.

The brine shrimp is a tiny animal (1/8 - 1/2") with jointed appendages and a chitinous or plastic-like outer skeleton.

An adult female reproduces when cultivated under optimum conditions. Drying of the eggs is a natural means of survival against drought for these organisms and they have been known to survive in this form for over ten years.

After soaking in a salt solution the eggs swell, burst, and a tiny pre-adult form emerges. Increasing the salinity slightly after hatching provides a more favorable environment for growth. With the proper care and feeding, successive molts (casting off of the outer skeleton) produces a mature adult in approximately six weeks. The ideal temperature is approximately 28°C or 82°F.

When examined closely with a hand lens you will notice that the animal swims on its back, exposing 6-8 pairs of appendages. These function both as a means of locomotion and as gills for breathing. The number of appendages can increase with the age of the shrimp.

After hatching, the young shrimp gather where the most light is available, while the adults avoid light.

RECIPE

RECIPE FOR HATCHING BRINE SHRIMP

16 tsp. non-iodized salt per one quart of water
3 tbs brine shrimp eggs sold as fish food in pet stores (to be called "pirates' dust")
airstone and pump (not necessary before they are hatched)
Brewer's yeast

Pre-boil water to remove chlorine. Stir non-iodized salt in the water and let stand for a few hours. Sprinkle eggs in the surface of the water. They will hatch within 48 hours if the temperature is approximately 27°C (80°F).

Stir eggs from time to time in order to insure aeration. Once the shirmp hatch, feed a pinch of Brewer's yeast twice a week and aerate with an airstone and a pump if available. Live brine shrimp are excellent food for your aquarium animals.

materials

- 1/2 cup of non-iodized salt
- 1 gallon of water
- 1/8 cup brine shrimp eggs available from a pet store
- Brewer's yeast
- several small baby food jars
- masking tape for labels
- 1 cup of dirt
- 1/4 cup of sugar
- magnifying glasses
- 2 pieces of white paper for each child to serve as a notebook

Optional Activity #1

OBSERVING WITH MAGNIFIERS

materials

- magnifying glasses
- white paper
- salt, pepper, sugar, grass, onion skin

A microscope is sometimes available from a local high school biology class. Its use is optional.

The purpose of these exercises is to introduce the students to making observations using magnifying glasses and a microscope, if available. Place the microscope and magnifiers in a safe, open area that is not easily bumped and is not in the path of heavy traffic.

Suggested Activity:

Arrange some familiar things (such as salt, pepper, sugar, and aquarium gravel) on six inch squares of white paper. Let the students examine them closely. Then supply them with magnifiers. Change the items every few days in order to keep interest aroused (i.e. onion skin, grass, pond water, etc.) Ask students to draw what they see with their eyes alone and then what they see with the use of the magnifiers. After a few days, begin to ask questions.

Do these things look the same?
Do any of them look the same?
How do they look different?

Put them into two groups according to one property.

What property did you pick?
Why?
Why would we want things to look bigger?

Activity #2

INVESTIGATING

Sprinkle some pirates' dust (brine shrimp eggs) on a piece of white paper in front of each child. Let's play super detective.

Which group can list the most number of clues (observations) about what is in front of them?

Provide magnifiers in case the students want to investigate further. Give the students enough time to write down what they learn from their eyes, nose, ears, and fingers (they can also taste a tiny bit).

Ask the children to write down guesses (inferences) where this dust might come from.

What they might eat?
What they might be?

Ask the class for their clues.

Are all of these observations?
Which are not?
Why?

Looking at the guesses, which guess is right?
Do you know for sure?
Could we find out if any of our guesses are right?

Activity #3

TAKING NOTES

Looking at the students' suggestions and inferences as to what the "pirates' dust" is, ask what they could do to find out.

How could we find out if this is coffee or a plant seed?

Provide materials with which they may experiment to find out what it is.

Teacher Tips:

At this time you might introduce the importance of time.

If we plant a seed in the ground, can we watch the tree reach the ceiling today?
How long did it take you to grow as tall as you are?
How long does it take for the sky to turn dark at night?
If we put a flame under a pot of water, does the water get hot right away?

Why not?
How fast does the light go out when I turn the switch off?

(Demonstrate whenever possible.) Some things take time to happen and some things do not...discuss.

Can you think of some things that take a long time to happen?
A short time to happen?
What if I poked you very hard?
How long did it take you to hurt?
How long would it take you to poke me back?

Can you make an inference as to what will happen if I put the pirates' dust in saltwater?
Sugar water?
How will we remember what we put into each jar?
(Label.)

Encourage the students to use magnifiers.

Throughout the next few days watch very carefully and make notes in your detective's notebook. Today we will draw what they look like and what we think might happen to the pirates' dust. Tomorrow and the next day we will look very closely and draw what we see.

Activity #4

HATCHING

Let the students draw the changes that they see in the pirates' dust. Discuss the changes and observations that were noted.

Does the dust look the same?
How is it different?
Does it smell the same?
Has the water changed?
Can you make an inference as to what will happen if we put them in the aquarium?
Where did the brine shrimp go?
Why?
Did all the animals in the aquarium eat the shrimp?
What do you think the brine shrimp eat?
Can you make an inference as to whether it will eat the starfish?
Why?

Once the brine shrimp hatch, (probably within two days), begin to discuss whether they are alive.

Why?
What do living things need?
What do we have to do to take care of them?
How can we find out?
Do they look like any other animal in the aquarium?
How are they the same?
Different?
Did any of them die?
Why did some of them die?
Do you know for sure?

SECTION VII

EVALUATION

Process: Observing
Inferring
Classifying

Content: Evaluation of unit objectives using four new marine animals

Behavioral Objectives:

1.--to cooperate within groups
2.--to show an ability to follow directions in removing and replacing marine animals in the aquarium
3.--to keep verbal or pictorial records of observations and inferences
4.--to group the living things in the aquarium according to a single property and according to more than one property
5.--to name three observations and two inferences about an inanimate familiar object
6.--to name two observations and two inferences about an aquarium animal
7.--to list five observations that would make them think that something is alive
8.--to name five or more things that something alive needs

Teacher Tips:

The purpose of this lesson is to apply the process and attitude skills learned in this unit to four new marine plants and animals.

- four new marine specimens (a combination of plants and animals is best) available from a local pet or aquarium store
- two pieces of white paper for each child stapled together as a notebook (see previous lesson)
- four containers made of glass or plastic with a piece of black construction paper wrapped around it

Activity #1

A GAME--OBSERVING AND INFERRING

(Objective 1)

Give each group of students a new aquarium specimen without letting the other groups see. Allow several minutes for careful observation. Use established teams and team names.

Rules of the game:

One team goes to the front of the room. They give one clue (observation) about their animal and the other teams have to guess what it is. If no one can guess, then give another clue. The team that gets a point is the one that can guess the animal or plant first.

Activity #2

LET'S BE DETECTIVES--RECORD KEEPING

(Objective 2)

Supervised by the teacher, have one person in each group place their specimen in the aquarium using the proper procedure. (Objective 3)

Following the directions for brine shrimp notebooks, ask the students to pick one of the animals in the aquarium and make a notebook, listing as many observations and inferences as they can through pictures or words.

Activity #3

CLASSIFYING

(Objective 4)

Can you put the living things in the aquarium into two groups according to one property?
What property did you pick?
Can you think of another way to group them?
Can you put them into two groups according to more than one property?
Is there a "right" way to group these animals?

Activity#4

STUDENT EVALUATION

For students of the second grade, these questions may be asked orally to each individual child. Third grade students who can read and write may be able to answer these questions in written form. However, a word of caution, if you choose to give your students a written test, you may be testing skills of reading and writing rather than inquiry.

(Objective 5)

1. Hold up an inanimate familiar object (such as a pencil, chalk, match or eraser) and ask for the following:

   A. Three observations (clues)
   B. Two inferences (guesses)

2. Point to an animal in the aquarium and ask for the following: (Objective 6)

   A. Two observations
   B. Two inferences

3. Ask for five or more observations that make them think that something is alive. (Objective 7)

4. **If something is alive, what does it need?** (Objective 8)

   Can you name five or more things?

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APPENDIX A

AQUARIUM SUPPLIES

Aquarium Stock Company
27 Murray Street
New York, New York 10007

Aquarium Systems, Inc.
1450 East 289th Street
Wickliffe, Ohio 44092

Coral Reef Exhibits
Box 2214 AMF Branch
Miami, Florida 33159

Hawaiian Marine Imports, Inc.
465 Town and Country Village
Houston, Texas 77024

Norfolk Neptune Wholesalers
1922 Colonial Ave.
Norfolk, Virginia 23517

Ocean Odyssey
9444 Main Street
Fairfax, Virginia 22039

Pacific Marine Imports
5420 W. 104th Street
Los Angeles, California 90045

Salt Water City
2231 Judah Street
San Francisco, California 94122

World-Wide Aquarium Supply Co.
2899 Nostrand Ave.
Brooklyn, New York 11229

APPENDIX B

MARINE LIFE SUPPLIERS

Carolina Biological Supply Co.
2700 York Road
Burlington, N.C. 27215

General Biological Supply House
Turtox
8200 South Hoyne Ave.
Chicago, Illinois 60620

Gulf Specimen Co., Inc.
P.O. Box 237
Panacea, Florida 32346

Marine Biological Lab.
Woods Hole, Massachusetts 02543

Northeast Marine Specimens, Co., Inc.
P.O. Box 1
Woods Hole, Massachusetts 02543

APPENDIX C

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Pasadena, California 91007

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Severna, Maryland 21146

Churchill Films
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Los Angeles, California 90069

Coronet
65 E. South Water Street
Chicago, Illinois 60601

Encyclopaedia Britannica, Inc.
425 N. Michigan Ave.
Chicago, Illinois 60611

Indiana Films
Audio Visual Center
Bloomington, Indiana 47401

International Film Bureau
232 S. Michigan Ave.
Chicago, Illinois 60604

Learning Corporation of America
1350 Avenue of the Americas
New York, New York 10019

MacMillan
34 MacQuesten Pky. S.
Mount Vernon, New York 10550

Marine Education Center
VIMS - Sea Grant
Gloucester Point, Virginia 23062
Gloucester Point, Virginia 23062

National Geographic
Dept. 77
P.O. Box 1640
Washington, D. C. 20013

NOAA
U. S. Dept. of Commerce
Film Department
Rockville, Maryland 20852

Paramount Films
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Hollywood, California 90038

Pyramid Films
Box 1048
Santa Monica, California 90406

APPENDIX D

BOOK PUBLISHERS

Children's Press, Inc.
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Chicago, Illinois 60607

Thomas Y. Crowell Co.
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New York, New York 10022

Harper and Row Pub., Inc.
10 E. 53rd Street
New York, New York 10022

Holiday House, Inc.
18 E. 53rd Street
New York, New York 10022

Hubbard Scientific
1946 Raymond Drive
P. O. Box 104
Northbrook, Illinois 60062

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Division of Children's Press
1224 W. Van Buren Street
Chicago, Illinois 60607

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Division of Random House, Inc.
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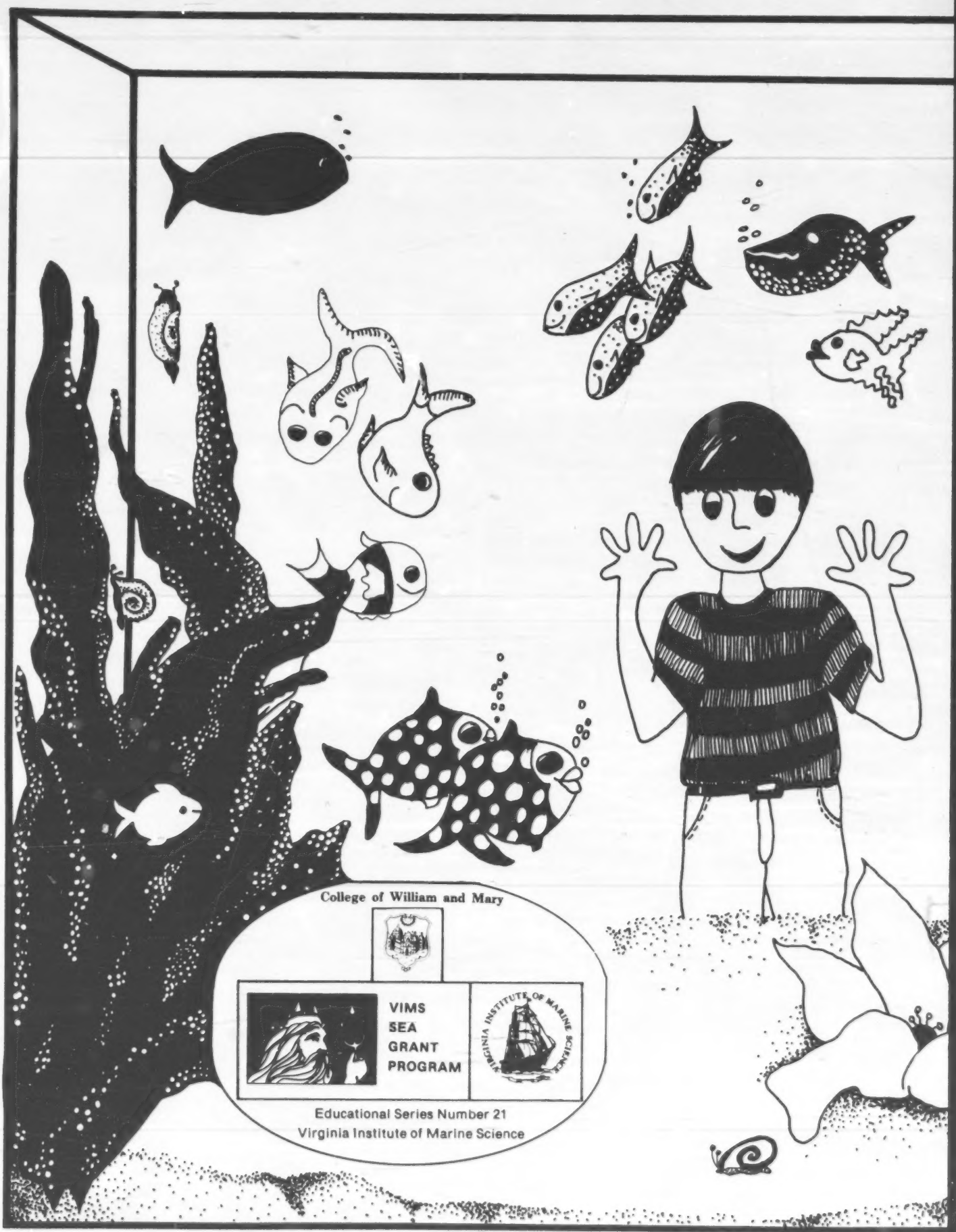
New York, New York 10022

Charles Scribner's Sons
597 Fifth Ave.
New York, New York 10017

Stony House Corp.
Charlotteville, New York 12036

Henry Z. Walck, Inc.
Division of David McKay Co.
Promotion Dept.
750 Third Ave.
New York, New York 10017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